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E1F FAC FAC5

(56) Documents Cited
GB 2211225 A GB 2204895 A GB 0307212 A
GB 0271839 A EP 0333450 A1 US 4372622 A

(58) Field of Search
UK CL (Edition M) E1F FAC
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(54) **Drill pipe protector**

(57) A protector 1 for a drill-pipe in a borehole has a body member 2 in two parts 6, 7 to be clamped around the drill-pipe, and friction-reducing means 3 extending beyond the outer surface of the body member so as to touch the inside wall of a cylindrical pipe or casing within which the drill-pipe is located. The friction reducing means may be spherical or cylindrical or elliptical rollers 3, or spherical or toroidal members (not shown) made of low friction material.

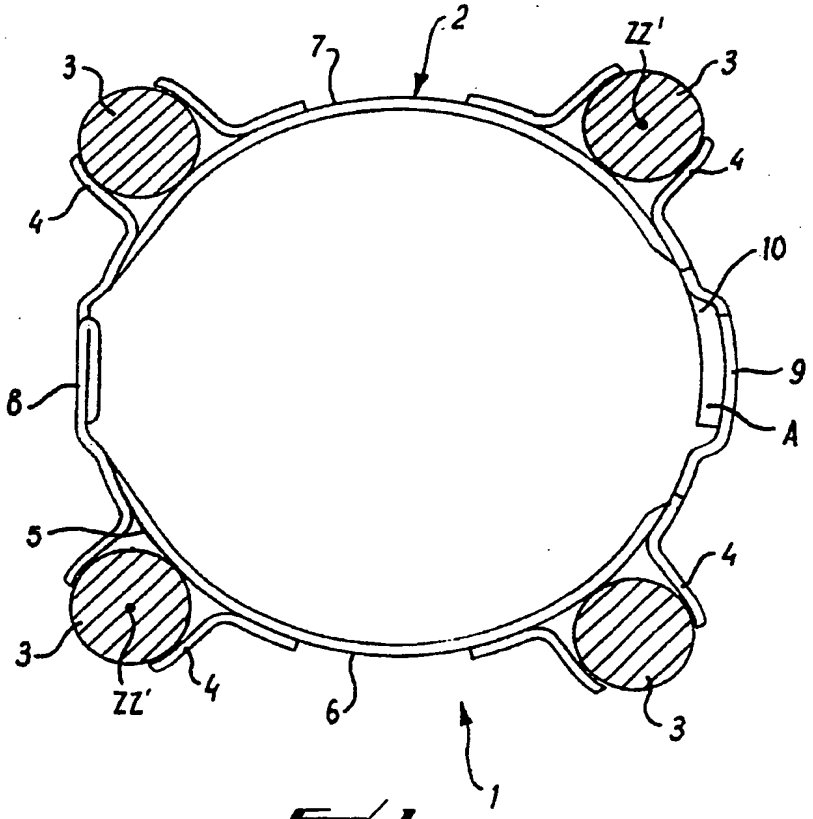

FIG.1

At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

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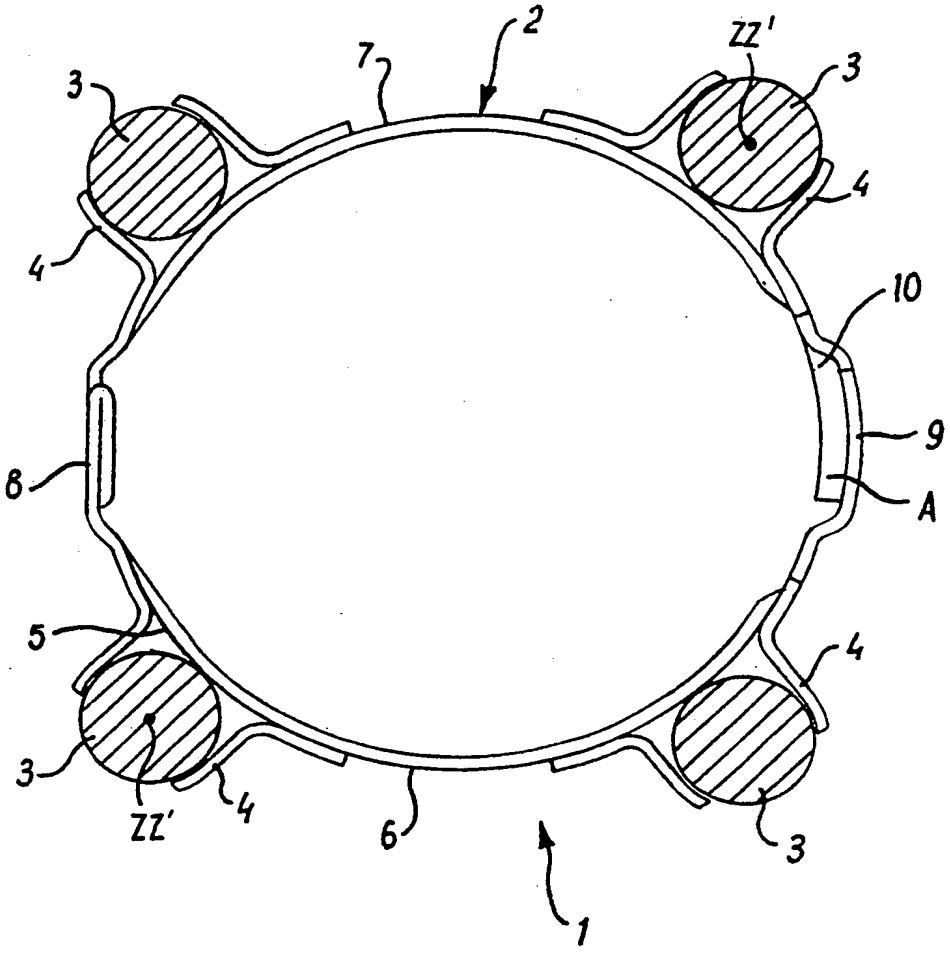

FIG. 1

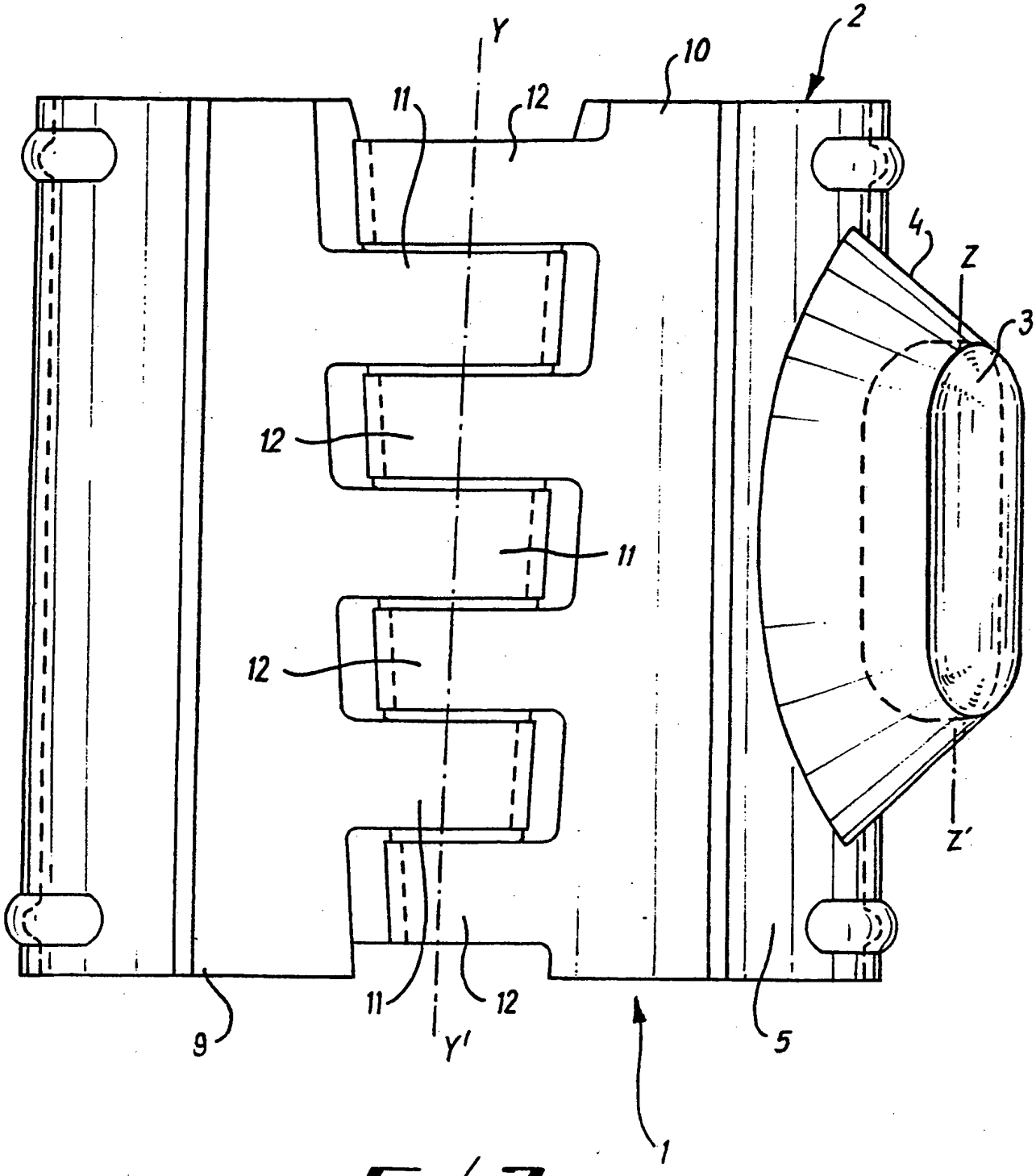

FIG.2

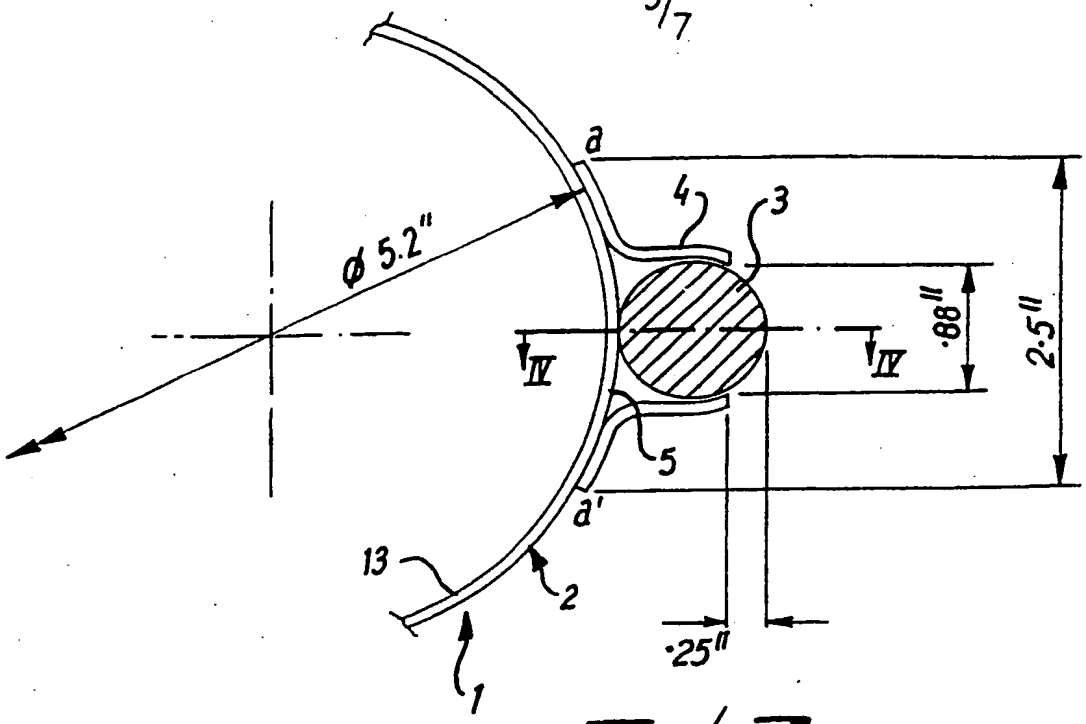

FIG. 3

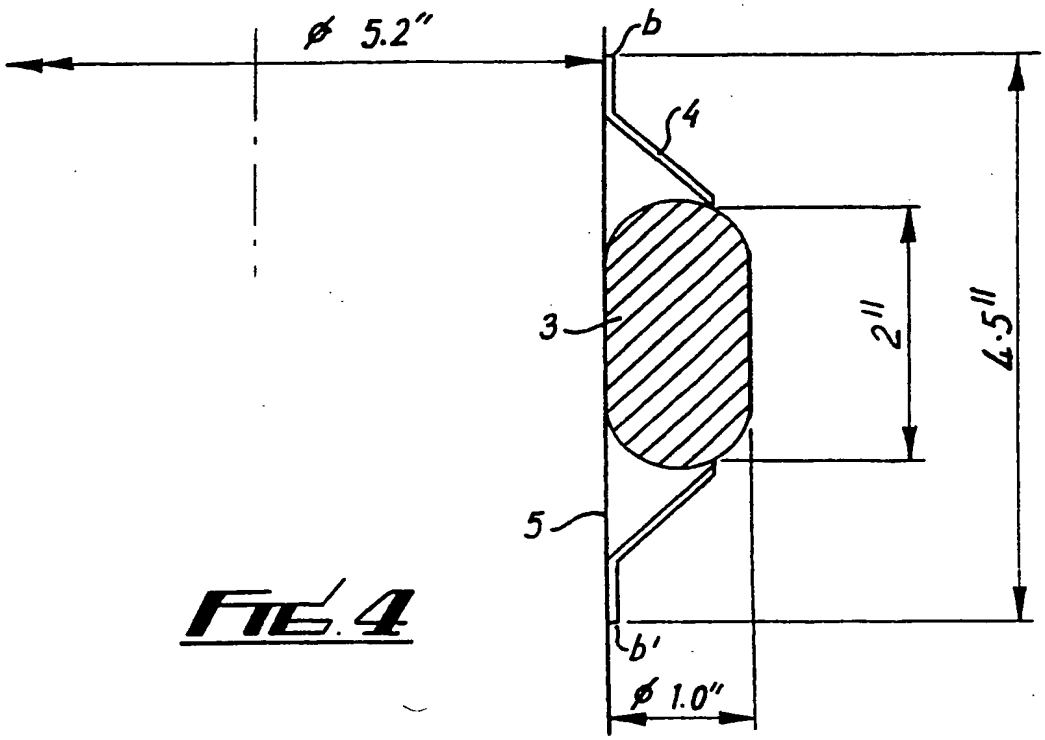

FIG. 4

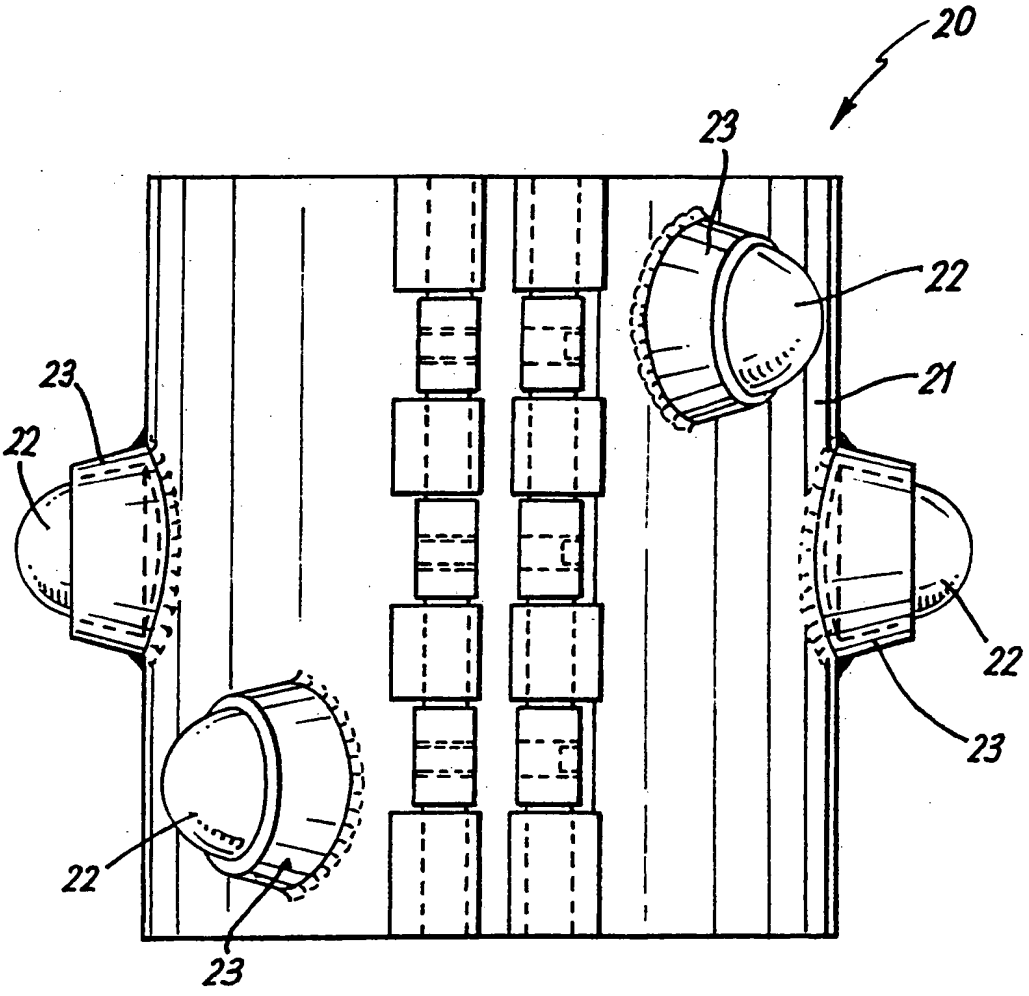

FIG.5

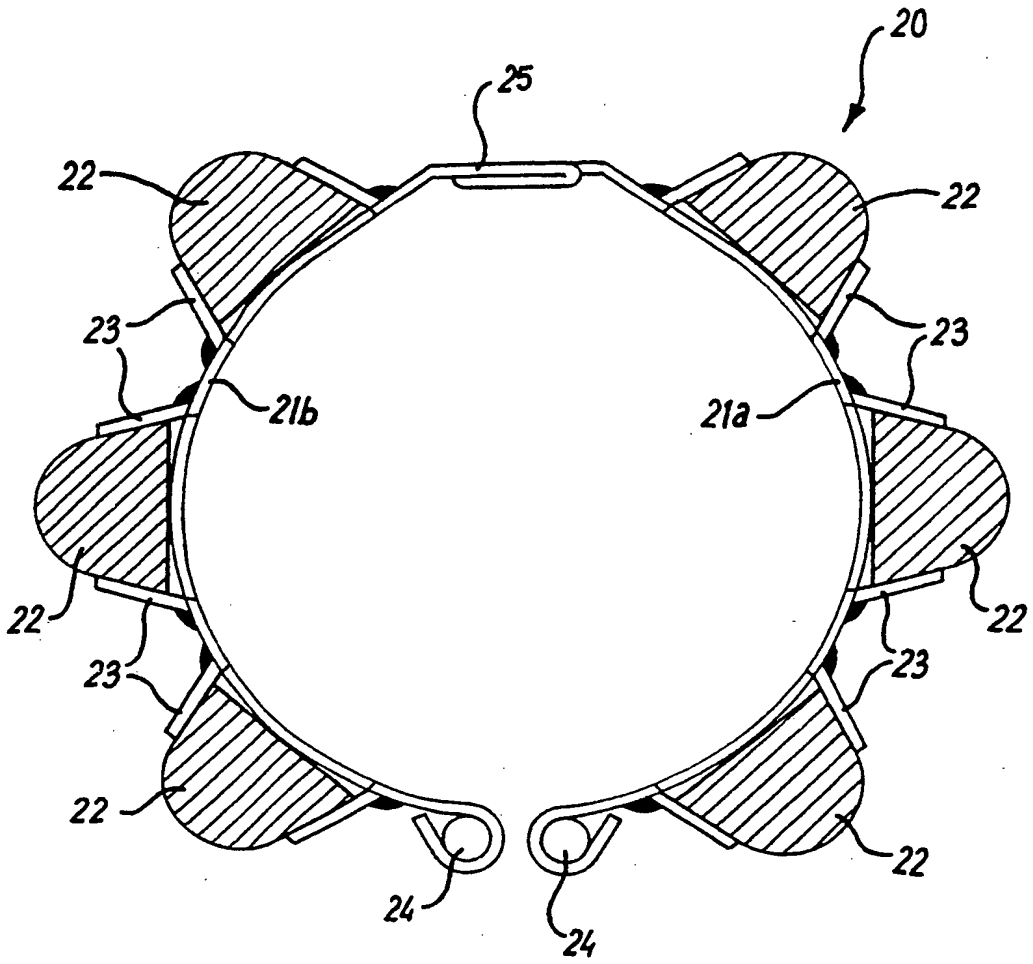

FIG. 6

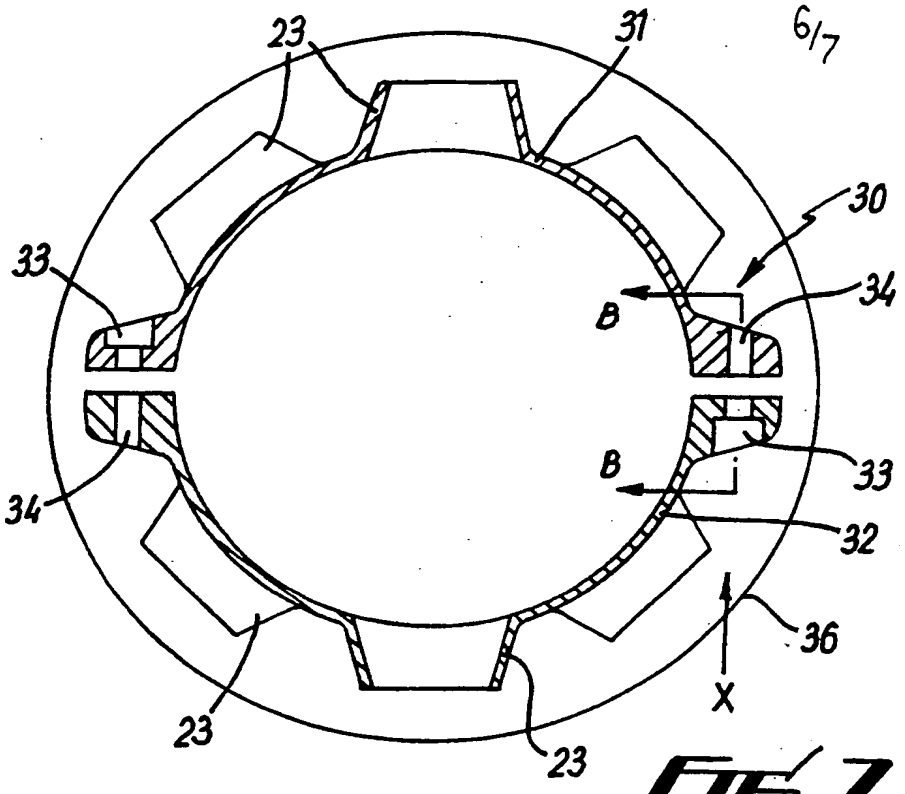

FIG. 7

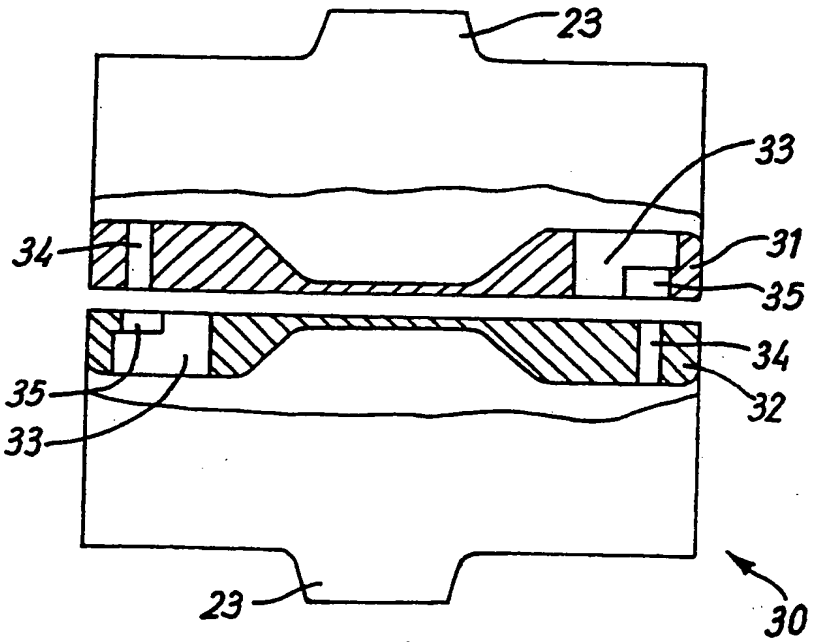

FIG. 8

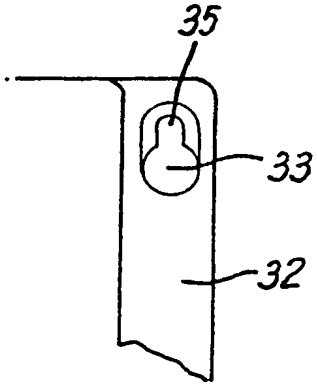

FIG. 9

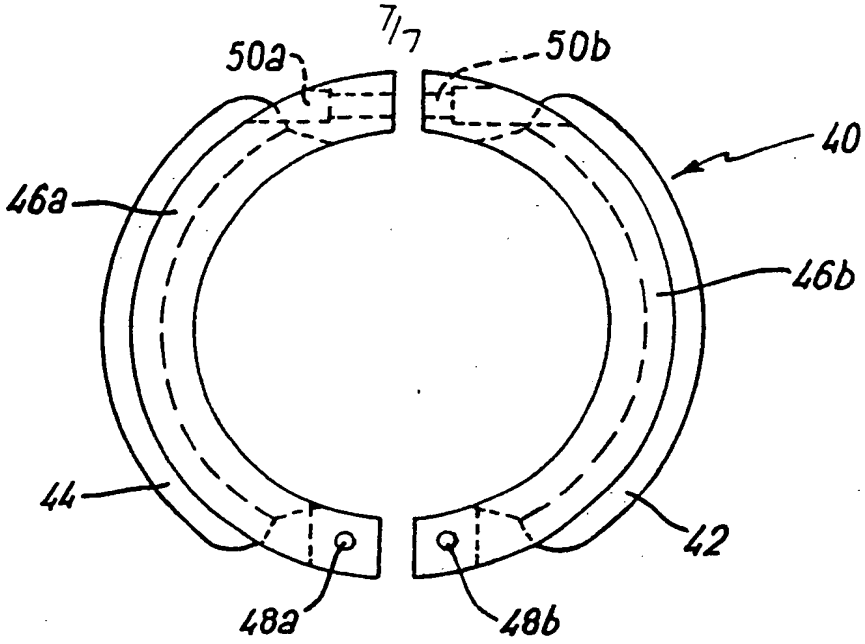

FIG. 10

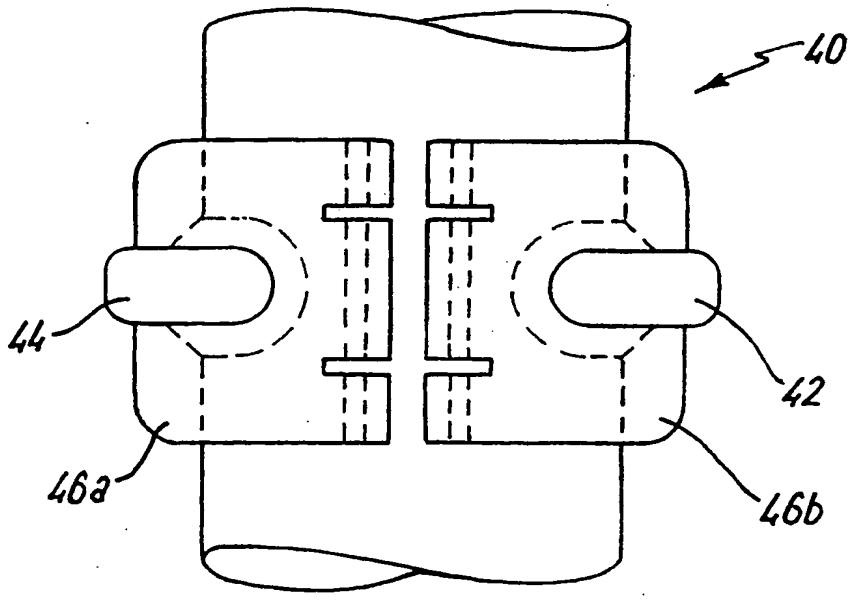

FIG. 11

"A Protector"

This invention relates to a protector for a tubular member in a borehole and in particular, but not exclusively, a drill-pipe protector.

When drilling boreholes, such as for oil and gas, it is necessary to maintain constant rotation of the drill-bit which in the case of rotary drilling involves rotation of drill-pipe. In order to replace the drill-bit the drill-pipe is also required to be removed from the borehole. This frequent movement in and out of the borehole together with the rotation in the borehole frequently results in damage to the drill-pipe and/or casing lining the borehole.

In order to prevent or at least to reduce the amount of damage, protectors are clamped around the drill-pipe. Conventional protectors are made from rubber which contain an internal steel case to provide grip.

However, these rubber protectors have several disadvantages. The use of the rubber protectors is limited to conditions where the temperature is below about 250°F. In view of this, these conventional

protectors would be unsuitable for use in geothermal drilling applications where the temperature may be as high as 500 to 600°F.

In addition, during the drilling procedure, muds are utilised for lubrication and for removal of waste material. However, conventional rubber drill-pipe protectors are prone to attack by oil-based drilling muds which cause swelling and a reduction in physical properties leading to premature wear.

A further disadvantage of the conventional rubber drill-pipe protector is that in the event of a gas kick into the well bore, gas may penetrate the rubber such that when the drill-pipe and protector are withdrawn from the borehole, the gas expands and causes blistering of the rubber.

An additional disadvantage is that there is not a high gripping force between the rubber drill-pipe protector and the metal drill-pipe such that the drill-pipe protector may slip during drilling, particularly if the operator has not fitted the protector correctly.

In the drilling operation, torque is applied to the drill-pipe, and it is desirable to reduce friction between the rotating drill-pipe and borehole to minimise the torque required to rotate the drill-pipe. Conventional rubber drill-pipe protectors can increase this friction, which is undesirable.

In accordance with the present invention there is provided a protector for a tubular member in a borehole, the protector comprising a body member adapted to be fitted to said tubular member, and

friction reducing means mounted on the body member, and a surface of the friction reducing means extending beyond the outer surface of the body member and the tubular member.

In one example of the invention the friction reducing means may comprise a friction reducing member mounted on the body member, the surface being formed from a material having a low coefficient of friction. The surface may be part-spherical or part-toroidal, and there may be a plurality of such surfaces. The friction reducing member could be formed from a low friction coefficient material or could be formed from a low friction coefficient coating on a base material.

In another example of the invention the friction reducing means may comprise a rotation member, the axis of the rotation member being substantially parallel to the longitudinal axis of the body member, and the rotating surface of the rotation member extending beyond the outer surface of the body member and the tubular member.

Preferably, the body member includes more than one rotation member, each rotation member being rotatably mounted on the body member. Typically, the body member includes three or more rotation members and preferably includes four rotation members.

Typically, the rotation member is generally ellipsoidal or cylindrical in shape. Alternatively, spherical balls may be employed as rotation members. However, in the preferred embodiment the rotation member is a roller rotatably mounted on the external surface of the body member.

Preferably, the friction reducing member or the rotation member is made from a low friction coefficient material such as polytetrafluoroethylene (PTFE), ceramics, steel, an alloy, or any other suitable material.

Preferably, the body member is made from a durable material, such as metal.

Preferably, the body member is in the form of a collar adapted to be closed around the tubular member. The tubular member may be, for example, a drill-pipe.

Typically, the rotation member is located within a housing on the external surface of the body member.

Preferably, the housing located on the external surface of the body member is made from the same material as the body member. Typically, the housing is attached to the body member by, for example, welding or rivetting.

Most preferably, the body member comprises first and second generally semi-cylindrical members pivotably connected to one another, at least one rotation member being located within a housing on the external surface of at least one of said members, such that when the body member is closed around the tubular member an end of the first member engages with an end of the second member. Preferably also, the body member is locked in position by a removable locking member.

A suitable locking member may be, for example, a tapered locking pin which extends longitudinally through apertures in the first and second ends of the body member. Alternatively a suitable locking member

may be, for example, a bolt and flange.

Examples of a protector in accordance with the invention will now be described with reference to the accompanying drawings, in which:-

Fig. 1 is a cross-sectional view of a first example of a drill-pipe protector;
Fig. 2 is a side view of the drill-pipe protector shown in Fig. 1;
Fig. 3 is a cross-sectional view of the drill-pipe protectors shown in Figs. 1 and 2;
Fig. 4 is a sectional view on line IV-IV of Fig. 3;
Fig. 5 is a side view of a second example of a drill-pipe protector;
Fig. 6 is a cross-sectional view through the protector shown in Fig. 5;
Fig. 7 is a cross-sectional view through a third example of a drill-pipe protector with friction reducing members removed;
Fig. 8 is a sectional view along the line BB of Fig. 7;
Fig. 9 is a view along the arrow X in Fig. 7; and,
Fig. 10 is a plan view and Fig. 11 is an elevation of a fourth example of a drill-pipe protector.

Fig. 1 shows a cross-sectional view of a generally cylindrical drill-pipe protector 1 in the form of a collar 2 with rollers 3 located inside housings 4 on the external surface 5 of the collar 2. Each roller 3 is cylindrical in shape with hemi-spherical ends and is free to rotate in both the clockwise or anti-clockwise directions about their longitudinal axis. The collar 2 comprises first and second generally semi-cylindrical

members 6 and 7, hingeably connected to one another by a hinge mechanism 8 such that the collar 2 may be closed around a drill-pipe (not shown). In the closed position as shown in Fig. 1, an end 9 of the first member 6 engages with an end 10 of the second member 7. The collar 2 may be locked in position by insertion of a tapered locking pin (not shown) through apertures formed in inter-engaging formations 11 and 12 on ends 9 and 10 of the members 6 and 7 (see also Fig. 2).

Fig. 2 shows a side view of the drill-pipe protector 1 as shown in Fig. 1. The rollers 3 are partially enclosed within housings 4 secured to the external surface 5 of the collar 2 and are free to rotate around longitudinal axes ZZ'. In the closed position, elongations 11 of an end 9 of the first member 6 engage in an alternate manner with elongations 12 of an end 10 of the second member 7. The collar 2 may be locked in position by insertion of a tapered locking pin (not shown) through apertures (not shown) in the elongations 11 and 12, along the direction YY, as previously discussed.

Fig. 3 is a cross-section view of a portion of the drill-pipe protector 1 of Figs. 1 and 2, showing one of the rollers 3 located within its housing 4. The housing 4 is attached to the collar 2 which has an external diameter of about 5.2 inches. The width of the housing 4 at the area of attachment to the external surface 5 of the collar 2, namely between the points a and a^1, is 2.5 inches. The width of the external aperture in the housing 4 through which the roller 3 partially projects is 0.88 inches. The roller 3 protrudes from the housing 4 by 0.25 inches.

A sectional side-view of the roller 3 and housing 4 of Fig. 3 is shown in Fig. 4, where the length of the housing 4 taken from the area of attachment to the external surface 5 of the collar 2, namely between the points b and b' is 4.5 inches. The length of the external aperture in the housing 4 in which the roller 3 is contained is 2 inches. The diameter of the roller 3 is 1 inch.

The surface of the drill-pipe protector 1 may be complete as shown in the example above, or it may have apertures in an area behind the rotation members to provide an exit for, for example, mud fluid.

Figs. 5 and 6 show a second example of a drill-pipe protector 20 which comprises a collar 21 with a number of friction reducing members 22 mounted on the surface of the collar 21 in housings 23. The collar 21 comprises two halves 21a, 21b connected at one side by a hinge 25 and can be coupled at the other side by a removable pin (not shown) which pins sections 24 together.

The friction reducing members 22 are manufactured from a relatively low friction coefficient material, such as polytetrafluoroethylene (PTFE), ceramics, steel, alloy, or any other suitable material.

In use, the protector 20 is used and operates in a similar manner to the protector 1, with the exception that the friction reducing members 22 replace the rollers 3.

Figs. 7 to 9 show a third example of a drill-pipe protector 30. In Figs. 7 and 8, the protector 30 is

shown with the friction reducing members removed, but the protector 30 and the friction reducing members are the same as that shown in Figs. 5 and 6. The protector 30 differs from the protector 20 in that each half 31, 32 of the protector 30 is identical and the halves 31, 32 are clamped together by means of four bolts (not shown). The bolts pass through bolt holes 33, 34 on each end of each half 31, 32. As shown in Figs. 8 and 9 the bolt holes 33 are "key-hole" shaped to permit the heads of the bolts (or nuts) to pass through the hole 33 and then engage in slot 35 to retain the halves 31, 32 together.

The circle 36 in Fig. 7 represents the maximum outside diameter of the protector with the friction reducing members fitted. It can be seen that the diameter is such that when in use within cylindrical pipe or casing of the same or similar diameter, only the friction reducing members will touch the inside wall of the pipe or casing.

The internal surface of the drill-pipe protectors 1, 20, 30 may include an additional layer such as steel mesh, which provides enhanced gripping force between the drill-pipe protector and the drill-pipe.

Figs. 10 and 11 show a fourth example of a drill-pipe protector 40 which has a friction reducing member in the form of a two-part band 42, 44 of generally toroidal shape projecting beyond the surface of a collar 46 in two halves 46a, 46b. The halves of the collar are hinged at hinge points 48a, 48b and can be bolted together by bolts (not shown) passing through apertures 50a, 50b in the opposite ends of the halves from the hinge points.

The parts of the band 42, 44 taken together extend around approximately three quarters of the external surface of the collar 46 and may be manufactured from a low friction coefficient material such as polytetrafluoroethylene (PTFE). As in previous examples, the external diameter of the band 42, 44 is such that when in use within a cylindrical pipe or casing of similar diameter, only the curved surface of the low-friction band will touch the inside of the pipe or casing.

In a variation, two or more toroidally-shaped bands may be provided at spaced positions.

The drill-pipe protector of the present invention provides several advantages over the conventional drill-pipe protector in that the presence of the friction reducing members or the rotation members on the surface of the protector provide a load bearing surface which helps reduce the torque experienced by the drill-pipe during the drilling process. Furthermore, the materials from which the protector and rotation members or friction reducing members are made are such that they can withstand wide variations of temperature and pressure and are not sensitive to oil based mud formulations. In addition, the metal body member of the protector provides increased gripping force between the protector and the metal drill-pipe, which helps to prevent the protector from slipping.

Improvements and modifications may be incorporated without departing from the scope of the invention.

CLAIMS

1. A protector for a tubular member in a borehole comprising a body member adapted to be fitted to said tubular member, and friction reducing means mounted on the body member, a surface of the friction reducing means extending beyond the outer surface of the body member and the tubular member.

2. A protector according to claim 1, in which the friction reducing means comprises a friction reducing member mounted on the body member, the surface being formed from a material having a low coefficient of friction.

3. A protector according to claim 2, in which the friction reducing means is formed from a low friction coefficient material.

4. A protector according to claim 2, in which the friction reducing means is formed from a base material coated with a low friction coefficient material.

5. A protector according to any of the preceding claims in which the friction reducing means comprises a rotation member, the axis of the rotation member being substantially parallel to the longitudinal axis of the body member, and the rotating surface of the rotation member extending beyond the outer surface of the body member and the tubular member.

6. A protector according to claim 5, in which the body member includes more than one rotation member, each rotation member being rotatably mounted on the body member.

7. A protector according to claim 6, in which there are three or more rotation members.

8. A protector according to claim 7, in which there are four rotation members.

9. A protector according to any one of tne preceding claims in which the rotation member is generally ellipsoidal in shape.

10. A protector according to claim 5, in which the rotation member is generally cylindrical in shape.

11. A protector according to claim 5, in which the rotation member is generally spherical in shape.

12. A protector according to claim 5, in which the rotation member is a roller rotatably mounted on the external surface of the body member.

13. A protector according to claim 1 in which the friction reducing means is at least one band of low friction material of toroidal shape.

14. A protector according to claim 13, in which the band of toroidal shape extends around three quarters of the circumference of the body member.

15. A protector according to any one of the preceding claims in which the body member is in the form of a collar adapted to be closed around the tubular member.

16. A protector according to claim 15 having at least one rotation member located within a housing on the external surface of the body member.

17. A protector according to any one of the preceding claims in which the body member comprises first and second generally semi-cylindrical members pivotably connected to one another, at least one friction reducing means being located within a housing on the external surface of at least one of said member, such that when the body member is closed around the tubular member an end of the first member engages with an end of the second member.

18. A protector according to any one of the preceding claims in which the body member is locked in position by a removable locking member.

19. A protector for a tubular member in a borehole substantially as described herein with reference to any of the accompanying drawings.

Patents Act 1977
Examiner's report to the Comptroller under Section 17
(The Search report)

Application number
GB 9403276.0

Relevant Technical Fields

(i) UK Cl (Ed.M) E1F (FAC)

(ii) Int Cl (Ed.5) E21B

Search Examiner
D J HARRISON

Date of completion of Search
12 MAY 1994

Databases (see below)
(i) UK Patent Office collections of GB, EP, WO and US patent specifications.

(ii)

Documents considered relevant following a search in respect of Claims :-
1 TO 19

Categories of documents

X: Document indicating lack of novelty or of inventive step.

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A: Document indicating technological background and/or state of the art.

P: Document published on or after the declared priority date but before the filing date of the present application.

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Category	Identity of document and relevant passages		Relevant to claim(s)
X	GB 2211225 A	(EXXON PRODUCTION RESEARCH COMPANY) whole document, but see particularly page 4 line 16 to page 5 line 5	1,15,17,18
X	GB 2204895 A	(LLOYD & HERRERA) whole document, but see particularly page 4 line 8 to page 5 line 8	1,2,3,5,10,13,15
X	GB 307212 A	(CUTHILL) whole document	1,5,10
X	GB 271839 A	(US TOOL CO) whole document	1,5,6,7,10,11,12
X	EP 0333450 A1	(ANDERSON) whole document	1,5,6,7,11
X	US 4372622 A	(CHEEK) whole document	1,5,6,7,11

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